3. A Contribution to the Anatomy of *Scopus umbretta*.

By F. E. Beddard, M.A., F.Z.S., Prosector to the Society.

[Received November 5, 1884.]

The dissection of two specimens of *Scopus umbretta* has enabled me to bring a few notes upon its anatomy before the Society. One of these individuals lived in the Society's Gardens from 1880 to 1884, the other was sent to the late Mr. W. A. Forbes from Africa. Both were partially dissected by Mr. Forbes; and in preparing the following account I have had the advantage of consulting a few MS. notes left by him.

As but little is known about the structure of *Scopus*, its exact systematic position is still a matter of doubt; the facts that are known (and these are confined to the pterylosis and structure of the skeleton) appear to be on the whole in favour of placing *Scopus* among the Ciconiidæ, as has been done by Mr. Sclater in the most recent edition of the 'List of Animals.'

The arrangement of the feather-tracts in *Scopus* is described in some detail by Nitzsch, who has pointed out that the powder-down patches distinctive of the true Herons are absent from *Scopus*[1]: in this and in other pterylographical characters *Scopus* comes nearer to the Storks than to the Herons.

Our knowledge of the osteology of *Scopus* is at present entirely due to Prof. Parker, who has described its shoulder-girdle in his 'Monograph on the Shoulder-girdle and Sternum[2]. Some scattered remarks on the osteology of *Scopus* and the affinities which they indicate are also to be found in a memoir by the same writer on *Balæniceps rex*[3]. Prof. Parker is of opinion that *Scopus* is truly Ciconiine, and is connected with the true Herons by way of *Balæniceps* and *Cancroma*, the latter type being essentially Heron-like, while *Balæniceps* has "the Heron characters in preponderance."

It view of these facts, it is rather remarkable to find that Dr. Hartlaub, in his work on the Birds of Madagascar, definitely includes *Scopus* as a genus of the family Ardeidæ, separating it therefore entirely from the Storks; nevertheless it appears to me that there is in reality quite as much to be said in favour of the Ardeine as of the Ciconiine affinities of the bird, from a study, that is to say, of the muscles and viscera.

With regard to the latter, the only published notes (so far as I am aware) are to be found in Mr. Forbes's Report on the Tubinares collected by H.M.S. 'Challenger'; in that memoir Mr. Forbes has described the partly double condition of the pectoral muscle in *Scopus*, which I have referred to below.

Two plates illustrating the osteology of *Scopus* are to be found in the last published part of the magnificent 'Histoire Naturelle

[1] Pterylography (English Edition). Ed. Sclater: London, 1867, p. 130.

[2] Ray Soc. Publications (London, 1869), p. 165.

[3] Trans. Zool. Soc. vol. iv. p. 347 *et passim*. See also Trans. Zool. Soc. vol. v. p. 234.

de Madagascar,' but the letterpress has not yet appeared; M. Milne-Edwards no doubt intends to describe the osteology, and for that reason I have not entered into any description of it in the present paper.

External Characters.—Nitzsch does not refer to the condition of the oil-gland in his account of the pterylosis of *Scopus*, merely remarking its presence. In the two specimens before me the oil-gland is distinctly tufted, and has three orifices at its free end. I may also mention that there are 12 rectrices, and that the contour-feathers are furnished with an aftershaft.

Visceral Anatomy.—The *tongue* is comparatively small and triangular, agreeing in this respect with *Cancroma* and *Balæniceps* alone among the Ardeidæ; the other genera of the family possess a long slender tongue, extending nearly as far as the mandibular symphysis; the tongue in the Ciconiidæ is much as in *Scopus*.

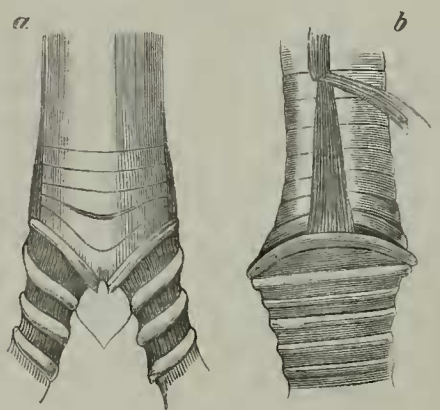
There is no *crop*; of the *liver* the right lobe is larger than the left; there is a conspicuous *gall-bladder* present, its duct opening on to the ascending loop of the duodenum.

There are two *carotids* with the normal course running up the neck side by side in the hypapophysial canal.

Both *jugulars* are present, the right larger than the left.

The *syrinx* is displayed in the two accompanying drawings

Fig. 1.



Syrinx of *Scopus umbretta*.
a, from before; *b*, from the side.

(figs. *a*, *b*). There are a pair of intrinsic muscles inserted on to the second bronchial ring (fig. 1), fanned out at their attachment; the first bronchial rings are ossified, and closely applied to the preceding rings of the trachea; the rings of the bronchi are incomplete internally and united by membrane; there is a well-developed bony pessulus, a prolongation of the last tracheal ring. The *bronchidesmus*, as Prof. Garrod has termed the fibrous membrane uniting the two bronchi, is incomplete, not extending as far forward as the point where the two bronchi bifurcate. The syrinx of *Scopus* is therefore not at all Stork-

like, and presents no important differences from that of the Herons and Bitterns. In the Storks (*cf.* Weldon, P. Z. S. 1883, p. 639) there are no intrinsic muscles; the bronchial rings are generally complete internally; the last tracheal and first bronchial rings are ossified and firmly united, while above them are a number of tracheal rings which are slender and delicate and often incomplete; the *bronchidesmus* (at any rate in *Tantalus* and *Leptoptilus argala*) is continuous up to the bifurcation of the bronchi.

The peculiar structure of the air-sacs described by Weldon in the Stork is not to be found in *Scopus*; the subbronchial sacs are completely fused, but the præbronchials are not divided up by septa as they are in the Stork. In these characters also *Scopus* is entirely unlike the Storks, and conforms to the Ardeine type.

Muscles of the Fore Limb.

1. The *latissimus dorsi* is composed, as in the majority of birds, of two distinct portions:—(1) the anterior arises from the spines of the second and third dorsal vertebræ, and is attached by a broad muscular insertion below the accessory tendon of *anconeus longus*; (2) the posterior half is the larger, but narrows rapidly towards its tendinous insertion in front of anterior half and continuous with accessory tendon of the *anconeus*.

2. The *cucullaris superficialis* is attached to the anterior half, or rather more, of the vertebral border of the scapula.

3. The *cucullaris profundus* is attached to the whole of the vertebral border of the scapula, except perhaps its extreme coracoidal end; the fibres of this muscle pass in a backward direction from the vertebræ to the scapula, while those of the *superficialis* pass in a forward direction, the two crossing each other very nearly at right angles.

4. The *serratus* arises in the ordinary fashion from ribs 2, 3, and 4, and is inserted on to the vertebral border of the scapula ventrad to the insertion of the *cucullaris* by a broad thin tendon for nearly half its length posteriorly.

5. The *deltoid* arises from the distal end of the scapula close to its articulation with the coracoid by a fleshy origin in front and by a short tendon behind; it is inserted on to the outer side of the crest of the humerus.

6. The *internal deltoid* arises from the tip of the coracoid, and is inserted on to the opposite side of the humeral crest, anterior to and somewhat below the insertion of the pectoral muscle.

7. The *pectoralis I.* arises from whole of hinder surface of sternum, from the entire extent of the carina sterni, and from the margin of the clavicle; it is inserted on to the crest of the humerus, and also to a fibrous aponeurosis which extends from the crest to the head of the humerus, covering the tendon of the biceps. The muscle itself is not actually double, but is partially divided by a tendinous septum, which is very evident on making a transverse section.

8. The *pectoralis II.* is of considerable size; its origin extends some two thirds down the sternum; it arises also from the sternal half of

the coracoid and from the coracoclavicular membrane; its insertion is not peculiar.

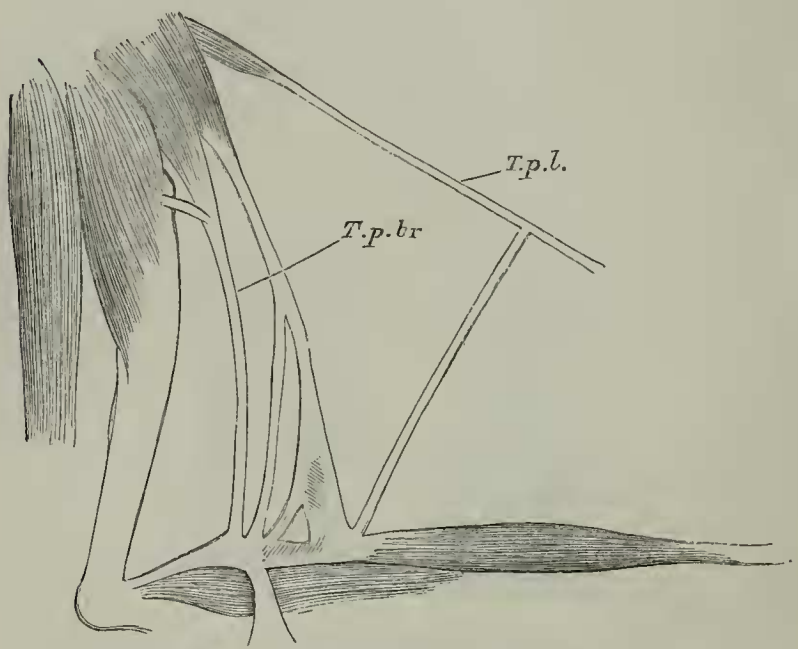
9. The *coracobrachialis externus* arises from the sternal end of the coracoid; it has the usual insertion.

10. The *coracobrachialis internus* is rather smaller; it appears to have the ordinary relations.

11. The *teres* arises from nearly the whole of the ventral margin of the scapula; just before it narrows into the tendon of insertion, it gives off a small tendinous slip which joins the *anconeus longus* close to its origin: it is inserted into the inferior capitular fossa just anterior to the origin of a portion of the *triceps*.

12. The *tensor patagii* muscle (fig. 2) is formed of the combined *brevis* and *longus*, which are not to be distinguished at their origin; it arises from the end of the clavicle and from a small portion of the scapula; the outer portion, which corresponds to the *tensor patagii*

Fig. 2.



Muscles and tendon of patagium of *Scopus umbretta*.
T.p.l, Tensor patagii longus; *T.p.br*, tensor patagii brevis.

longus (*T. p. l.*), receives a slip, chiefly tendinous, from the *pectoralis I.*; its tendon passes straight to the radial carpal bone, but about the middle of its course gives off a branch which joins the outer of the two tendons which form the *tensor patagii brevis*. The tendon of the *tensor patagii brevis* (*T. p. br.*) is double; at the junction of the belly of the muscle with the outer of the two tendons a small tendinous slip is given off to the crest of the humerus; the inner tendon receives a slip from the pectoral at a corresponding spot. The outer tendon

is continued without any change to the radial aponeurosis; the inner tendon about half way down gives off in front a broad, thin, flat tendon, which passes down parallel to the other half of the tendon and is inserted near to it; at this point it receives the slip from the tendon of the *tensor patagii longus* already referred to. There is no biceps slip to the patagium.

13. The *biceps* has the usual double origin, and is inserted on to the radial margin of the ulna and on to the ulnar margin of the radius.

14. The *anconeus longus* arises from the scapula close to the articulation of the humerus by a single head, the outer half of which is tendinous about half an inch from the origin; it gives off a broad flat tendon to the outer edge of the humerus; it ends below in a long stout tendon attached to the anterior border of the olecranon process of the ulna.

15. The *triceps* arises from the head of the humerus just external to the insertion of the *teres* and from a considerable proportion of the shaft; it blends with the *anconeus longus* at its insertion on to the ulna behind the latter.

The *expansor secundariorum* appears to be absent.

16. The *pronator radii superficialis* arises from the inner condyle of the humerus; it is inserted into the upper margin of the radius.

17. The *pronator radii profundus*, twice as large as the last, arises from the humerus below it; it is inserted on to the radius below the insertion of the last, and extends considerably beyond. Between the two pronators is a small muscle which arises in common with the *pronator profundus*; it is attached partly to the tendinous surface of the latter and partly by a slender tendon to the radius.

18. The *flexor carpi ulnaris* is a strong muscle arising by fleshy origin from distal extremity of humerus; it is inserted by a long thick tendon on to the ulnar carpal bone.

19. The *external anconeus* arises from the common tendon from the external condyle of humerus; it is inserted into the proximal one half of the upper part of the ulna (except at the extreme end).

20. The *extensor carpi ulnaris* arises from a long tendon from outer condyle of humerus together with the *anconeus externus*, and from the tendinous septum between it and the latter; it is inserted by a long tendon about one third of the way down the metacarpal of digit II. on the outer inferior margin.

21. The *extensores carpi radialis longus* and *brevis* arise from the outer condyle of humerus above all the other muscles of the forearm; they are in close contact for the whole of their length, and are inserted on to the tuberosity of the metacarpal of the first digit.

22. The *extensor communis digitorum* arises from the outer condyle of the humerus above and a little behind the *extensor carpi ulnaris*; it divides at the base of the thumb into two tendons, the first of which is attached to the digital margin of the phalanx of the pollex; the other is similarly attached to the second phalanx of digit II.

23. The *supinator* is a small muscle arising from outer condyle of humerus to the inside of and above the common tendon; it is attached to upper surface of radius.

24. The *internal anconeus* arises from internal condyle of humerus below all the other muscles; it spreads out in a fan-like manner to be inserted on to the ulna superficial to (below) the attachment of the *brachialis internus*.

25. The *brachialis internus* is a broad, flat muscle arising from the deep pit on the inside of the humerus; it is inserted on to the ulna close to the *internal anconeus*.

26. The *flexor digiti II. major* arises by a moderately long tendon from the inner condyle of humerus; it is connected by flat tendinous bands with the secondaries; about an inch before the wrist it divides into two tendons, one of which runs forward and is attached to the internal tendon of the wrist; the other, the main tendon of insertion, passes round the wrist, and is inserted on to a considerable portion of the inner anterior margin of the first phalanx of the index; during the latter part of its course the tendon of this muscle is crossed by that of the

27. *Flexor digiti II. minor*.—This muscle arises from the middle portion of the radial margin of the ulna, commencing just in front of the insertion of the *brachialis internus*, and extending as far forward as the origin of the *extensor internus*; its tendon passes above that of the flexor major, and is inserted on the anterior edge of the second phalanx of the index, close to its proximal end.

28. The *extensor internus manus* arises from the distal half of the ulna, commencing just after the attachment of *flexor digiti II. minor*; it is nearly twice the size of the latter; its tendon passes round to the extensor side of the wing, and is there inserted on to the anterior upper edge of the thumb metacarpal.

29. The *extensor pollicis* arises from distal half of ulnar margin of radius superficial to origin of *extensor indicis* and from posterior half of ulna and interosseous membrane; it is inserted on to the extensor margin of metacarpal below the *extensor metacarpi radii*.

30. The *extensor proprius indicis* arises from the ulnar margin of radius; its tendon passes below that of *extensor communis digitorum*, and receives a short muscular slip from the wrist; it is attached to the extensor margin of the proximal end of the second phalanx of the index.

I have not dissected out the intrinsic muscles of the hand.

Muscles of the Hind Limb.

1. The *sartorius* arises only from the front end of the ilium; its insertion is on to the tibia just above the crural.

2. The *crurœus* arises from nearly the whole of the inner side of the femur; it is inserted by a short tendon on to the head of the tibia, below and to the inside of the insertion of the *sartorius*.

3. The *pectineus* is a small delicate muscle arising from the lower margin of the ilium just beneath the origin of the *glutœus*; it passes

outwards and backwards to be inserted on to the inner side of the femur just between the origin of the *crurœus* and *vastus internus*.

4. The extensor muscle of the thigh is composed of a number of fused muscles; it arises from both the inner and outer side of shaft of femur; it is inserted on to the patella and on to the fascia, covering the knee by a broad flat tendon.

5. Of the glutæal muscles, the outermost one (*glutœus I.*) is the largest. *Glutœus II.*, which partly underlies *glutœus I.*, is somewhat smaller. *Glutœus III.* is very small.

6. The *obturator externus* is large; it is covered superiorly by an aponeurosis, which extends back about half way to the posterior extremity.

7. The *obturator internus* has an oval origin; its tendon of attachment is surrounded by a muscular mass which corresponds to the *gemelli*.

8. The *tensor fasciæ* extends about half way down the thigh; it originates from the fascia covering *glutœus I.*

9. The *biceps* arises from the whole of the postacetabular ridge of the ilium; it is inserted, as usual, on to the fibula, after passing through a tendinous sling.

10. The *femoro-caudal* is a long, slender muscle, with the usual origin and insertion; the tendons at either end of the muscle are extremely fine.

The *accessory femoro-caudal* is quite absent.

11. The *semitendinosus* is well developed: it arises from the posterior end of the ilium and from the fascia in the neighbourhood; it is inserted on to the tendon of the gastrocnemius (see fig. 3) in common with the *accessory semitendinosus*.

12. The *accessory semitendinosus* is moderately large; it arises by fleshy origin from inferior margin of femur close to its distal extremity, and is inserted partly on to the oblique tendon between it and the *semitendinosus*, and partly on to the tendon which connects the latter with the gastrocnemius.

13. The *semimembranosus* is half as broad again as the *semitendinosus*; it arises from the lower margin of hinder portion of ischium and from a small portion of the pubis posteriorly; it is inserted by a thin broad tendon on to the inner side of the leg.

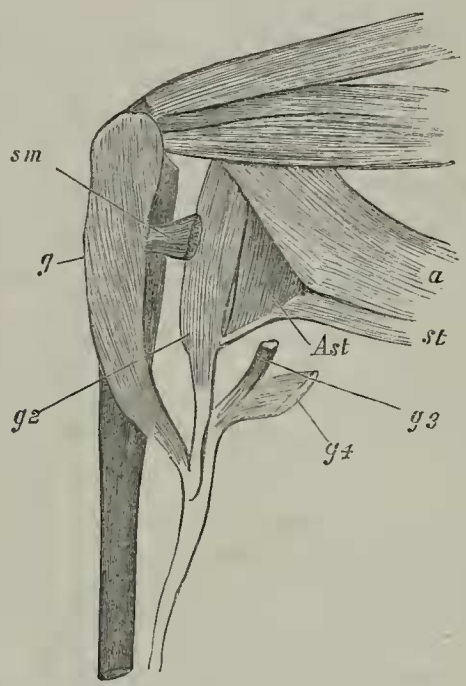
The *ambiens* is absent.

14–15. There are two *adductor* muscles.

16. The *gastrocnemius* arises by four distinct heads, which unite about half way down the leg into a broad flat tendon gradually narrowing until its insertion:—(*a*) The external head arises from the under surface of the femur; it is tendinous on the inner side, where it fuses with the outer loop of the biceps sling. (*b*) The second head arises from the femur by a thin flat tendon below the origin of the last. (*c*) The third head arises from the inner side of the under surface of the femur; it is fused with the inner of the two adductor muscles at its origin; about half way down it receives the tendon of the conjoined *semitendinosus* and *accessory semitendinosus*. (*d*) The inner head is the largest; it arises from the

femur just ventral to the insertion of the sartorius from the fascia covering the fore part of knee and for some distance below from the cnemial crest of the tibia, and from the fascia between it and the *tibialis anticus* near the upper end of the latter.

Fig. 3.



Muscles of leg of *Scopus umbretta*.

a, Adductor; *st*, semitendinosus; *Ast*, accessory semitendinosus; *sm*, semimembranosus; g, g^2, g^3, g^4, gastrocnemius.

The arrangement of the *gastrocnemius* and the adjacent muscles will be understood from the accompanying figures (fig. 3).

17. The *plantaris* is a small slender muscle; it arises from the hinder part of tibia on inside of the leg posterior to the insertion of the semimembranosus.

18–19. The superficial flexor tendons are like those of other birds; the *flexor perforatus et perforans* supplying the 2nd and 3rd digits, while the *flexor perforatus* supplies the 2nd, 3rd, and 4th.

The deep tendons (see fig. 4) have rather a peculiar arrangement.

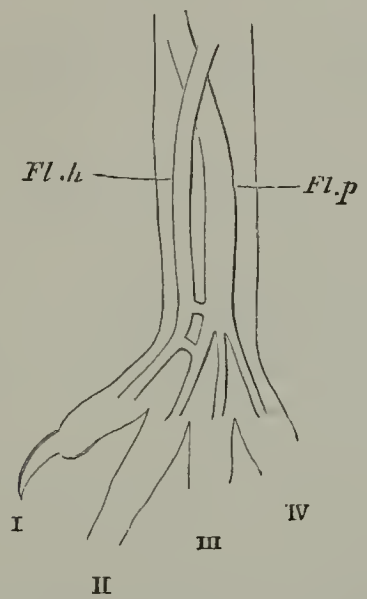
20–21. The tendon of the *flexor hallucis* is connected with the *flexor profundus* by a vinculum just before the latter divides into the tendons of the several digits; it also gives off a special slip, which joins the branch of the *flexor profundus* going to the 2nd digit.

22. There is but one *peroneus* present; it arises chiefly from the fascia covering the *tibialis anticus* and from the crest of the tibia; its

tendon gives off a broad ligament to the ankle, and then becomes fused with the tendon of the *flexor perforatus et perforans* of the 3rd digit.

23. The *tibialis anticus* is made up of two portions: the larger arises from the cnemial crest of the tibia, the smaller from the front part of the outer condyle of the humerus. The two unite to form a strong tendon, which is inserted in the usual fashion.

Fig. 4.



Deep plantar tendons of *Scopus umbretta*.
Fl.h, Fexor hallucis; *Fl.p*, flexor profundus digitorum

24. The *extensor digitorum* is a small muscle arising from the crest of the tibia and from the front part of the bone for the space of about an inch; its tendon supplies all the digits with the exception of the first.

In the foregoing description of the muscles of *Scopus*, more attention has been paid to those which are known to vary in the different groups of birds.

In his paper on certain Muscles in Birds[1], Prof. Garrod distinguished the Pelargi from the Herodiones by the presence in the former of the *ambiens* muscle, *two* intestinal cæca, and a double pectoral muscle; in both groups the *femoro-caudal*[2], *semitendinosus*, and *accessory semitendinosus* were present. In a subsequent paper[3], however, Prof. Garrod stated that the *ambiens* was not always present in the Storks, since he failed to find it in *Xenorhynchus senegalensis* and *Abdimia sphenorhyncha*; it is therefore impossible to separate the two

[1] Coll. Papers, p. 221.
[2] Absent in a few Storks, e. g. *Leptoptilus argala*. [3] Coll. Papers, p. 421.

families by the presence or absence of the *ambiens*; and the fact that *Scopus umbretta* has not the *ambiens*, but has the *semitendinosus*, its accessory, and the *femoro-caudal*, is no clear indication of its affinities with either. In the condition of the *pectoral* muscle, however, *Scopus* decidedly agrees with the Ardeidæ and differs from the Ciconiidæ.

The disposition of the deep plantar tendons is not *characteristically* "Ciconiine." In all the Herons and Storks dissected by Prof. Garrod the tendon of the *flexor longus hallucis* sends down a vinculum to join the tendon of the *flexor perforans digitorum* before the trifurcation of the latter, the vinculum being extremely slender in the Herons and altogether absent in *Botaurus stellaris*. I find, however, that the condition of the deep plantar tendons in *Scopus* is exactly repeated in *Ciconia nigra*. In this bird Mr. Forbes[1] has figured a precisely similar arrangement to that which I have described in *Scopus*; the tendon of the *flexor hallucis* sends off a special slip to digit II. as well as a vinculum to the *flexor perforans* just before its trifurcation.

In the absence of the *expansor secundariorum*, *Scopus* agrees with *Cancroma* and *Egretta*[2] and the Ciconiidæ; this muscle is present in all Herons except the two genera mentioned.

The tendons of the patagium do not differ much from what is found in other Herodiones; the absence of a *biceps* slip is characteristic of both Storks and Herons.

The muscular anatomy of *Scopus*, on the whole, appears to combine the characters of both the Ciconiidæ and the Ardeidæ. On myological grounds only it would be difficult to assign it definitely to either group; in fact, the only features in which this genus especially resembles the Herons and differs markedly from the Storks are the form of the syrinx and the air-sacs, while, as already stated, the arrangement of the feather-tracts and the structure of the skeleton are more particularly Stork-like. It is clear, therefore, that *Scopus* is in many respects an intermediate type between the Ciconiidæ on the one hand and the Ardeidæ on the other; and its relation to both may be seen at a glance from the accompanying table:—

	Scopus umbretta.	*Herons*.	*Storks*.
Pectoral muscle	Not completely double.	Not completely double.	Completely double.
Ambiens	Absent.	Absent.	Rarely absent.
Deep plantar tendons	*fl. h.* with a special slip to dig. II. and a vinculum.	*fl. h.* with slender vinculum only, sometimes absent.	*fl. h.* with special slip to dig. II.; a vinculum (in *Ciconia nigra*).
Expansor secundariorum.	Absent.	Absent (except in *Cancroma* and *Egretta*).	Present.
Origin of obturator internus.	Oval.	Triangular.	Oval.
Syrinx	With intrinsic muscles; anterior rings of bronchi incomplete, closed by membrane.	With intrinsic muscles; anterior rings of bronchi incomplete, closed by membrane.	Without intrinsic muscles; rings of bronchi complete.
Cæca	2.	1.	2.

[1] MSS.

[2] Garrod, Coll. Papers, p. 329.

The facts contained in this paper appear to me to be an additional reason for uniting together the Storks and Herons more closely than was done by Garrod; and the classification adopted by Mr. Sclater in the most recent edition of the 'List of Animals,' so far as this is concerned, expresses the facts. But it might be advisable to separate *Scopus* as the type of a family Scopidæ, equivalent to both the Ardeidæ and the Ciconiidæ, and to place it between them as an indication that it forms a connecting link. It is not impossible that *Balæniceps* should also be included in this family.

4. Note on the Presence of an Anterior Abdominal Vein in *Echidna*. By F. E. Beddard, M.A., F.R.S.E., Prosector to the Society.

[Received November 11, 1884.]

Although several excellent memoirs upon the various systems and organs of *Echidna* have from time to time appeared, there remain a considerable number of details of the structure of this most interesting mammal that require investigation. The death of the female specimen lately living in the Society's Menagerie has given me the opportunity not only of preserving certain parts for histological examination, but also of studying the anatomy of the animal in a fresh condition. In this way I have been able to make out a structural point which I believe has not been yet recorded, and which appears to me to be of some interest—that is, the presence of an *anterior abdominal* or persistent *allantoic* vein.

In the excellent account given by Prof. Balfour, in his 'Comparative Embryology,' of the development of the venous system in Vertebrata, I find the following statement:—"The venous system[1] of mammals differs in two important points from that of Reptilia and Amphibia. . . . . The anterior abdominal vein is only a fœtal vessel forming during fœtal life, the allantoic vein." With regard to its subsequent history in Mammalia, Prof. Balfour says[2]:—"The allantoic (anterior abdominal) veins are originally paired. They are developed very early, and at first course along the still widely open somatic walls of the body, and fall into the single vitelline trunk in front. The right allantoic vein disappears before long, and the common trunk formed by the junction of the vitelline and allantoic veins becomes considerably elongated. This trunk is soon enveloped by the liver . . . At the close of fœtal life the allantoic vein becomes obliterated up to its place of entrance into the liver . . . Owing to the allantoic (anterior abdominal) vein having merely a fœtal existence, an anastomosis between the iliac veins and the portal system by means of the anterior abdominal vein is not established."

In the Reptilia and Amphibia, on the other hand, the anterior abdominal veins are represented in the adult condition as well as during fœtal life.

In the Amphibia, as in the Mammalia, there are at first two abdo-

[1] Comparative Embryology, vol. ii. p. 541. [2] *Ibid.* p. 546.